

GD Feb 2013
claim 20, further comprising:

increasing an ion bombardment energy over the wafer surface when the second plasma sheath surface area is greater than the first plasma sheath surface area.

REMARKS

The Examiner is thanked for the careful review of this application. Claims 14-21, are pending after entry of this Proposed Amendment. Claims 14, 16, and 20 have been amended to clarify the claimed invention as described below. Applicants respectfully submit no new matter is presented and, at the very least, the proposed amendments present the rejected claims in better form for consideration on appeal, should appeal be taken of the present application. Further, Applicants submit the proposed amendments place the application in condition for allowance. Therefore, Applicants respectfully request that this Proposed Amendment be entered.

Applicants are filing this response within two months of the date of mailing of the Final Office Action in conformance with MPEP Section 714.13. A response in accordance with this section is kindly requested.

Rejections under 35 U.S.C. §112

Claims 16, and 18-21 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. Specifically, the Office has maintained the §112 rejection based on the phrase “at least about” at line 3 of claim 16. Applicants herein propose to amend line 3 of claim 16 to recite --at least--. Applicants respectfully request reconsideration of the §112 rejection in light of the proposed amendment.

Rejections under 35 U.S.C. §103

Claims 14-21 were rejected under 35 U.S.C. §103(a) as being unpatentable over Degner et al. (U.S. Patent No. 5,074,456) in view of Chang et al. (U.S. Patent No 4,854,263). This rejection is respectfully traversed, and Applicants respectfully request reconsideration in light of the proposed amendments to claims 14 and 21.

Applicants’ independent claim 14, as proposed to be amended herein, claims a method for making a top electrode for use in a chamber for processing a semiconductor

wafer through plasma etching operations. The chamber includes a support chuck for holding the wafer, and a pair of RF power sources. The method includes forming the top electrode to have a center region, a first surface and a second surface. The first surface has an inlet that is configured to receive processing gases from a source that is external to the chamber, and to flow the processing gases into the center region. The second surface has a plurality of gas feed holes that lead to a plurality of electrode openings. The diameters of the electrode openings are greater than diameters of the gas feed holes. The plurality of electrode openings are configured to define the second surface which is located over a wafer surface of the semiconductor wafer. The method for making the top electrode includes forming the second surface to define a second surface area. The wafer surface defines a wafer surface area. The second surface area is defined to be larger than the wafer surface area such that when a plasma is struck between the second surface and the wafer surface, the plasma defines a first plasma sheath surface area that is proximate to the wafer surface and a second plasma sheath surface area that is proximate to the second surface area. The second plasma sheath surface area is greater than the first plasma sheath surface area.

Degner et al. show a composite electrode useful particularly in parallel plate plasma reactor apparatus. Degner et al. teach a pair of baffle plates located between a backing plate and an electrode plate, as well as a plurality of orifices in the electrode plate through which reactant gases are distributed. However, Degner et al. do not show or suggest the Applicants' claimed electrode. According to Degner et al., "The [electrode] plate will generally be flat and free from protuberances..." Although Degner et al. do not describe in detail the reactant gas orifices, the design and purpose of the orifices is essentially for introduction of reactant gases while minimizing "non-uniformities in the thermal, electrical, and structural properties of the disk." Degner et al. show a flat-surfaced, composite electrode.

Chang et al. describe a gas manifold that can act as an electrode used in a plasma-enhanced chemical vapor deposition system (PECVD). Essentially, Chang et al. teach chemical vapor deposition onto a substrate, and the stated objects are providing a gas manifold designed to increase the dissociation and reactivity of gases such as nitrogen, providing an improved parallel plate and gas inlet manifold configuration for forming low hydrogen content silicon nitride films at high deposition rates using nitrogen with reduced ammonia or without ammonia. Chang et al. also state that an objective of the invention is to provide an improved parallel plate electrode and gas inlet manifold configuration for

forming silicon oxide films and for forming low hydrogen content silicon oxynitride films at high deposition rate using nitrogen with reduced ammonia or without ammonia.

As Applicants have previously submitted, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references when combined must teach or suggest all the claim limitations. (MPEP §2143). Applicants respectfully submit the Office has failed to establish a *prima facie* case of obviousness, and request reconsideration of the §103 rejection in light of the proposed amendments to independent claim 14.

Specifically, the combination of the cited references fails to teach all of the claim limitations of Applicants' independent claim 14 as proposed to be amended. Applicants maintain previously submitted argument, and further submit that neither Degner et al. nor Chang et al., either standing alone or in combination, teach a method for making a top electrode that includes forming the second surface to define a second surface area, the wafer surface to define a wafer surface area, and the second surface area being defined to be larger than the wafer surface area such that when a plasma is struck between the second surface and the wafer surface, the plasma defines a first plasma sheath surface area that is proximate to the wafer surface and a second plasma sheath surface area that is proximate to the second surface area. The method recites, and the cited references, either alone or in combination, fail to teach or suggest, forming a top electrode so that a second plasma sheath surface area is greater than the first plasma sheath surface area.

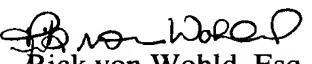
For at least the above reasons, Applicants respectfully submit that independent claim 14, as proposed to be amended, is patentable over Degner et al. in view of Chang et al. Claims 15-21, also as proposed to be amended and each of which directly or indirectly depends from independent claim 14, are all likewise patentable for at least the same reasons. The patents to Degner et al. and to Chang et al., either alone or in combination, simply do not teach or suggest the features of the Applicants' claimed invention recited in Applicants' independent claim 14 as herein proposed to be amended.. The Office has therefore failed to establish a *prima facie* case of obviousness with respect to Applicants' claims 14-21, and Applicants therefore respectfully request reconsideration of the §103 rejections in light of the proposed amendments.

In view of the foregoing, Applicants respectfully submit that claims 14-21 as herein proposed to be amended are in condition for allowance. Accordingly, a Notice of Allowance is respectfully requested. If Examiner has any questions concerning the present amendment, the Examiner is kindly requested to contact the undersigned at (408) 5 749-6900, ext. 6905. If any additional fees are due in connection with filing this amendment, the Commissioner is also authorized to charge Deposit Account No. 50-0805 (Order No. LAM1P077A).

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Respectfully submitted,
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MARKED UP CLAIMS:

The claims are herein amended as indicated.

5 14. (Three Times Amended) A method for making a top electrode for use in a chamber for processing a semiconductor wafer through plasma etching operations, the chamber including a support chuck for holding the semiconductor wafer and a pair of RF power sources; the method comprising:

10 forming the top electrode to have a center region, a first surface and a second surface, the first surface [has] having an inlet that is configured to receive processing gases from a source that is external to the chamber and flow the processing gases into the center region, the second surface [has] having a plurality of gas feed holes that lead to a plurality of electrode openings that have electrode opening diameters that are greater than gas feed hole diameters of the plurality of gas feed holes, the plurality of electrode 15 openings [are] being configured to define the second surface which is located over a wafer surface of the semiconductor wafer,

wherein the second surface is configured to define a second surface area and the wafer surface defines a wafer surface area, the second surface area being larger than the wafer surface area such that when a plasma is struck between the second surface and the wafer surface, the plasma defines a first plasma sheath surface area that is proximate to the wafer surface and a second plasma sheath surface area that is proximate to the second surface area, the second plasma sheath surface area being greater than the first plasma sheath surface area.

25 16. (Three Times Amended) The method for making a top electrode for use in the chamber as recited in claim 15, further comprising:

forming the electrode openings to be at least [about] 0.5 mm or greater in diameter and the gas feed holes to have a diameter of about 0.1 mm.

20. (Twice Amended) The method for making a top electrode for use in the 5 chamber as recited in claim 18, further comprising:

striking [a] the plasma between the separation, the plasma having [a] the first plasma sheath surface area that is proximate to the wafer surface and [a] the second plasma sheath surface area that outlines an inner region of the top electrode openings, such that the second plasma sheath surface area is greater than the first plasma sheath 10 surface area.